revenues generated on the loop – local service, long distance service, vertical services, and ISP services.

The conclusion is that price squeezes are a real threat and safeguards must be put in place. Imputation rules enforced through tariff review may prevent obvious squeezes, but may not be adequate to disclose all instances of price squeezes. Ensuring cost based pricing of inputs sold to competitors is essential.

D. Regulation Will Not Deter ILEC Innovation

There are two aspects to this issue. One is the question of whether having to create a separate subsidiary will deter investment in broadband. The second is whether price regulation and unbundling will deter investment in broadband. With regard to price regulation, the ILEC argument is that reduced returns will deter risky investment. The analysis of this issue varies depending on whether the ILEC adopts a separate subsidiary. If there is a separate subsidiary, then the ILEC is free to earn a market return on the broadband investment made by the subsidiary as well as on the vertically related services such as provision of ISP services. This obviously provides positive incentives for investment even under the ILEC theory.

Even if fully regulated, the ILEC will make a competitive return on the monopoly inputs purchased by the subsidiary from the parent. As long as the prices for these inputs are set at the appropriate levels, there is every economic incentive for the ILEC to provide them. Prices are set at or above forward-looking economic cost, including a competitive return, thereby providing positive incentives for investment and deployment. This is of

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competition. The example used assumes that the CLEC is operating at an efficient scale.

course disputed by the ILECs. They argue that the prices of unbundled network elements are set too low. We would note first that the Commission has addressed this issue in the Local Interconnection Proceeding.[58] We would also note that few state Commissions have set unbundled network element rates at true forward looking costs, such as those generated by the HAI Model version 5.0a ("HM5.0a"). Instead Commission's have in many cases, and in our view inappropriately, accepted changed input values that do not reflect best practice or that do reflect embedded costs.

The ILECs argument that the Commission's rules for setting Total Element Long Run Incremental Costs ("TELRIC") unbundled network element prices do not provide for adequate returns was made on behalf of Bell Atlantic, by Dr. Jerry Huasman. Dr. Hausman argued that TELRIC pricing does not provide a return sufficient to induce the ILECs to undertake risky investment.[59] These arguments were addressed and rebutted in the interconnection proceeding.[60] First, the TELRIC-based rates include an 11.25 percent return – far in excess of the risk free treasury bill return. Second, Commission prescribed depreciation rates are forward-looking. Third, the models used to establish TELRIC rates, such as HM 5.0a developed by our firm, conservatively apply a nominal rate of return that includes an expectation of inflation to a model that does not inflate inputs at the expected inflation rate. The result is conservatively high cost estimates. As long as

[58] Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, CC Docket No. 96-98, First Report and Order, Released August 8, 1996 (First Interconnection Order)
[59] See Reply Affidavit of Jerry Hausman, filed on behalf of Bell Atlantic in CC Docket No. 96-98.
[60] See Kenneth Baseman, Frederick Warren-Boulton and Susan Woodward "Depreciation and Capital Recovery Issues, A Response to Professor Hausman," July 1996, submitted o behalf of MCI in CC Docket No. 96-98.

the TSLRIC-based costs include a competitive return, there is an economic incentive for ILECs to provide them.

The ILECs also argue that they will be saddled with stranded plant to the extent that they provide broadband capacity that is subsequently replaced by facilities-based customers. As discussed above, however, in the long run, more plant will be stranded if the ILECs do not provide broadband facilities to CLECs. In general, ILECs have a difficult time understanding that in competitive industries, write-offs are a commonly accepted risk. If ILEC profits were not so high, they would generate more sympathy for their argument.

The interexchange industry provides an example of how competitive firms evaluate opportunities to make capacity available to potential competitors. The major long distance carriers make capacity available to both resellers and facilities based competitors. Indeed, RBOCs have received substantial discounts from IXCs even though the RBOCs are the most significant potential facilities-based entrants into the long distance business. Firms such as Qwest and Level III are financing their entry into the long distance business by selling broadband capacity on their fiber routes to other firms.

E. Benefits and Costs of Separate Subsidiaries

As discussed above, separate subsidiaries can provide benefits if properly constructed and enforced. Section IV.C.2 above describes the requirements in detail. ILECs have argued that separate subsidiaries impose unnecessary costs. The first thing to recognize is that there are natural limits to the size and scope of firms. Diseconomies of integration limit the size and scope of firms. This issue is discussed in Section 1. The ILECs have also argued that discrimination can be adequately policed without separate

subsidiaries, using examples such as intraLATA toll and CPE. This issue is discussed in Section 2.

1. The Alleged Costs of Separation

The ILECs will argue that separate subsidiaries impose significant operational costs and deny consumers the benefits of economies of scope. The first point to understand is that markets allow efficiencies to be captured without the need for vertical integration. Existing CLEC competitors are efficient. They have acquired the technical expertise and facilities they need through efficiently functioning labor and equipment markets. Any claim that the affiliate must rely on expertise found only in the ILEC must be viewed with skepticism. It is more likely the case that the advantage of relying on the ILEC for facilities or expertise is simply that local monopoly ratepayers are providing subsidies.

Even if it were true that there are vertical economies associated with the provision of broadband services by an ILEC that cannot be captured through efficient input markets, it does not necessarily follow that integration should be allowed. The risk of discrimination and cross-subsidy must be weighed against any benefits of integration. As discussed above, the current unbundling rules are not working well to prevent discrimination. Moreover if the benefits of competitive supply at the final goods stage exceed the costs of monopoly supply when there are economies of integration, then consumers are better off with the restriction.

In any event, when ILECs assume that integration is necessary to generate economies of integration, they ignore one of the central findings of the Commission's Interconnection Order:

> The incumbent LECs have economies of density, connectivity, and scale; traditionally, these have been viewed as creating a natural monopoly. As we pointed out in our NPRM, the local competition provisions of the Act require that these economies be shared with entrants. We believe they should be shared in a way that permits the incumbent LECs to maintain operating efficiency to further fair competition, and to enable the entrants to share the economic benefits of that efficiency in the form of cost-based prices.[61]

Economies can be shared by entrants by unbundling network elements and pricing them at cost. Efficient unbundling is made technically feasible by the increased modularization of network components.

The ILECs will certainly claim that separate subsidiaries impose large cost burdens. Care must be exercised in evaluating these claims. Diseconomies of scope and economies of specialization argue in favor of smaller rather than larger firms. ILEC claims for economies of integration may be based on excess capacity. Excess capacity is necessary for economies of scope, but it is not sufficient. If there is excess capacity for integrated broadband services because a network is larger than it needs to be, or because features have been built into it that are not necessary for the provision of basic services, then there are no legitimate scope economies.[62] Excess capacity leads to economies of scope only when there is both excess capacity and when the plant is optimally designed and sized for providing the other services.

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[61] See Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, CC Docket No. 96-98, CC Docket No. 96-98, First Report and Order, 11 FCC Rcd 15499 (1996) ("Local Competition Order"), para. 11.

[62] For example, see the testimony of Joseph Gillan on behalf of the Florida Interexchange Carrier Association, Florida Public Utilities Commission, In re: Comprehensive Review of the Revenue Requirements and Rate Stabilization Plan of Southern Bell, Docket No. 920260, filed November 8, 1993, pp. 20-26 (documents substantial excess fiber optic transmission capacity installed by Southern Bell).

Regulators have a difficult time overseeing the investment decisions of the ILECs. capacity (in terms of both equipment and personnel) can be installed to benefit unregulated services. Therefore, ILEC scope economy claims must be treated with great skepticism. False economies of scope can be built into the design and operation of the network. For example, the decision to purchase features and functions useful primarily for providing broadband services provides the network with capacity to provide the services at a low short run incremental cost. The true cost of providing those services was incurred when the decision was made to procure those features and functions as a part of network architecture and design decisions.[63] Potentially large subsidies from basic monopoly to broadband services are possible when this occurs.

Many of the benefits of real (as opposed to false) scope economies can be captured without actual physical integration. To take a basic example, the loop connecting a home or a business with the public switched network can be used for local, long distance and enhanced service calls. Three loops are not necessary to provide these services. As a result, many companies can take advantage of economies of scope in the loop.

Mergers are often cited as general proof that organizational integration is necessary in the telecommunications industry. Several of these mergers may be a response to exploitation by the ILECs of their monopoly. Long distance carriers such as AT&T would not need to spend billions of dollars on wireless or cable technology if the ILECs would open their networks to offer new products and charge reasonable prices for

[63] See Section IV.C.1. above, which discusses the many ways in which discrimination and cross-subsidy

the services they do provide. In any event, there are many cases in which cooperation among players is achieved without integration. Finally, the Commission's proposed structural separation rules allow ILEC broadband service affiliates to resell the basic services of their parents. This provides them with the ability to develop integrated products without actual structural integration.[64]

c. History of ILEC Integration

In other contexts, the ILECs have argued that separate subsidiaries do not provide benefits. For example, on behalf of Bell Atlantic, Dr. William Taylor argued in the Commission's Section 272 separate subsidiary proceeding that BOC vertical integration into corridor and intraLATA long distance service, cellular, voice messaging (VMS) and customer premises equipment provide evidence that non-structural safeguards work to prevent discrimination.[65] Dr. Taylor also cited the presence of non-BOC local telephone companies in interLATA markets.

Neither corridor nor intraLATA toll services provide an adequate test of the proposition that discrimination by an integrated firm will not occur. In the case of corridor traffic, the ability of the BOC to do significant damage is limited because customers typically must dial around their presubscribed interLATA carrier in order to use the BOC for corridor calls. Cross-subsidy and discrimination are unlikely to overcome this large burden. In the case of intraLATA toll, BOCs have retained

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can be built into the design of the network.

[64] However, this very integration could cause substantial competitive problems. If ILECs fail to modernize or support the services of the parent, competitors who depend upon them will be disadvantaged.

[65] See Affidavit of William E. Taylor in CC Docket No. 96-149, Implementation of the Non-Accounting Safeguards of Sections 271 and 272 of the Communications Act, As Amended, April 16, 1997. ("Taylor Affidavit")

monopoly power precisely because they have engaged in significant discrimination. In particular, the BOCs refused to provide intraLATA equal access until ordered and then delayed its implementation. For example, Ameritech repeatedly challenged state commission orders to provide intraLATA one-plus presubscription, resulting in a serious delay of intraLATA toll competition. For almost ten years U S West successfully resisted orders from the Minnesota regulator to provide one-plus intraLATA dialing.

The problems do not stop once intraLATA equal access is ordered. The Kentucky and Florida Public Service Commissions found that BellSouth engaged in anticompetitive business office practices to disadvantage its intraLATA rivals.[66] Ameritech initiated "PIC freezes" in three of its five states, just when those intraLATA markets were opened to presubscription. (PIC freezes make it more difficult for consumers to switch carriers.) In Illinois and Michigan the PIC-freeze solicitations were found to be anticompetitive.[67] BOCs have also engaged in price squeezes in intraLATA toll markets.

There are also examples of non-BOC local telephone companies behaving anticompetitively in interLATA markets. For example, SNET has acquired a substantial share of the interLATA market in Connecticut despite having higher prices than competitors. This might be explained in part by premature termination of AT&T's billing contract with SNET.[68] In general, however, the incentives for discriminatory

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[66] See Florida Public Service Commission, Investigation into IntraLATA 1+ Presubscription, Docket Nos. 960658-TP and 930330-TP, December 23, 1996; Kentucky Public Service Commission, In the Matter of Implementation of IntraLATA 1+ Presubscription, Dockets 95-285 and 95-396, August 13, 1996.

[67] See MCI Telecommunications Corporation v. Illinois Bell Telephone Company, Illinois Commerce Commission Case Nos. 96-0075, 96-0084 (Order dated April 3, 1996); In the Matter of the Complaint of Sprint Communications Company L.P. Against Ameritech Michigan, Michigan Public Service Commission Case No. U-11038 (Opinion and Order dated August 1, 1996).

[68] See B. Douglas Bernheim and Robert D. Willig, p. 92.

conduct are higher for BOCs than for independent telephone companies. Due to their geographic scope, a higher portion of interLATA traffic both originates and terminates within their territory.

Dr. Taylor argues that experience in the cellular market provides evidence that the BOCs will not discriminate. The evidence Dr. Taylor cites for this proposition does not prove his point. For example, he points out that despite a late start, non-wireline suppliers have market shares that are, on average, virtually equal to those of the Bell cellular companies.[69] This is not at all surprising, given that cellular demand has been strong while each of the two competitors is constrained to half of the spectrum capacity.[70] Anticompetitive efforts to capture market share are unlikely to be profitable when capacity is constrained to begin with. Moreover, there were cellular interconnection disputes when the service commenced. Non-wireline carriers wanted to access local exchange networks on a carrier-to-carrier basis. The BOCs refused and offered instead to interconnect cellular carriers like any other large customer.[71] These disputes ended only after the BOCs came to dominate the non-wireline side of the business through acquisitions. Finally, large profits were available to cellular carriers without the need to discriminate further. The erosion of prices for wireless services with the entry of PCS shows that cellular pricing was not competitive.

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[69] Taylor Affidavit, para. 7.

[70] With fixed spectrum, a cellular carrier would have to engage in expensive cell site splitting to capture a large fraction of its competitor's traffic.

[71] Peter W. Huber, The Geodesic Network: 1987 Report on Competition in the Telephone industry (January 1987), pp. 4.12-4.15, describes early cellular interconnection disputes.

The information service business does not provide a useful guide. Until the information services restrictions in the MFJ were overturned by the Courts, the BOCs were not allowed to provide these services. As a result, their opportunity to engage in anticompetitive behavior was limited. However, efforts to provide more sophisticated interconnection arrangements for ISPs failed in part because the BOCs resisted meaningful unbundling for information services and in part because access charges are priced substantially above cost.[72]

Dr. Taylor specifically mentions VMS as a case of successful BOC participation in information services markets. Yet one of the most well known examples of discrimination by a BOC is BellSouth's efforts to favor its own Memorycall service by strategically altering the timing of unbundled network features.[73]

It is significant that these examples of discrimination and delay all took place in the face of regulation by this Commission or state commissions. Even if a commission attempts to redress discrimination, it is only after the discrimination has already occurred and therefore after substantial competitive harm has already taken place.

The next example cited by Dr. Taylor is customer premises equipment ("CPE"). CPE competition has flourished because the interface to the local network is simple and stable. Moreover, because the equipment manufacturing arm of the Bell System went with AT&T at divestiture and the BOCs were prevented from reentering manufacturing, opportunities and incentives for discrimination against equipment suppliers were reduced.

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[72] For a discussion of the failure of Open Network Architecture to provide for meaningful interconnection arrangements for ISPs, see Hatfield Associates, ONA: A Promise Not Realized (April 6, 1995).

[73] See, MemoryCall.

Nevertheless, there have been competitive problems in the high end of the CPE business, where the BOCs' Centrex service competes. For example, Bell Atlantic delayed introduction of ISDN capability for PBX trunks for over a year after introducing the ISDN feature for its own Centrex service.[74]

F. Enforcement Is Essential

A rule designed to promote broadband competition by preventing ILEC discrimination is only as good as its enforcement. This Section discusses the need for consistency of enforcement and for adequate penalties and remedies.

1. Consistency of Enforcement

If the Commission adopts safeguards sufficient to limit the exercise of market power, a safe prediction is that the first response of the ILECs will be to seek waivers. They will claim that technology or circumstances make the rules inapplicable. This is precisely what happened when the Commission imposed separate subsidiary rules on the Bell System in CI II.

The CI II rules were designed to ensure that unregulated and potentially competitive enhanced services would be offered in a fully separated subsidiary. Within Shortly after the rules became effective, the Bell System petitioned for a waiver to allow provision of voice mail by the monopoly parent instead of the competitive subsidiary.[75] The Commission ultimately denied the waiver, but only after a long proceeding.[76] The

[74] See B. Douglas Bernheim and Robert D. Willig, Chapter 4, p. 97.
[75] See AT&T Petition for a Waiver of Section 64.702 of the Commission's Rules and Regulations, 88 FCC 2d 1 (1981).
[76] Id.

Commission found that the Bell System had not provided verifiable empirical evidence that economies would be lost.[77]

The point to be made here is that protracted waiver proceedings like this create uncertainty for all market participants, particularly actual and potential competitors of the ILEC. A barrage of waiver requests will produce uncertainty over the ultimate terms on which broadband services will be provisioned. This can only reduce investment by competitors and delay the services demanded by consumers. This argument, of course, cuts both ways. Once the rules are adopted, ILECs are entitled to consistency as well, subject to provisions discussed in the next Section.

2. Penalties and Remedies

As noted in the introduction to this Section, compliance is a function of both detection and penalties. Penalties for violating separate subsidiary and unbundling rules are problematic. The Communications Act simply does not contain heavy penalties. In another context, Posner has argued that penalties should equal the income transfers and economic welfare loss associated with the violation.[78] Of course, if the probability of detection is low, a firm may choose to break rules even if this is the penalty imposed. A deterrence-based penalty would make violations unprofitable, given the probability of detection.[79]

Given the problems with detection and the relatively low penalties available to the Commission, a more effective deterrence mechanism must be found. Moreover, the

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[77] Id., para. 55.
[78] See Richard Posner Economic Analysis of Law, 4th ed., (1992), p. 277

trigger for the remedy should be related to results rather than to behavior. Specifically, if after a reasonable period, say two years, effective broadband competition is not developing, specific further remedies should be triggered. For example, instead of a separate subsidiary for broadband service, ILECs could be quarantined from providing these services. Alternatively, the Commission may want to consider imposing a stronger remedy such as Divestiture II, whereby the core of the existing monopoly would be spun off into a separate economic unit. Finally, the Commission should consider requiring interconnection agreements to contain specific damages to be paid to CLECs when there is a failure to comply with interconnection obligations.

V. Recommended Broadband Technology Principles

This Section recommends technology principles the Commission should adopt concerning advanced broadband services. These principles, if adopted, will complement and enable the Commission's proposals for the treatment of advanced broadband services, and buttress the competitive safeguards the Report proposes.

Section A first presents concepts that underlie the technology principles that are specified in Section B. Section B presents the principles themselves, accompanying each with a brief explanation. The Appendix, titled Broadband Technologies, provides technical details underlying the principles.

A. Background Concepts

This Section begins with a description of the components of a local broadband network and then describes xDSL technology in detail.

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[79] See Gary Becker, "Crime and Punishment: An Economic Approach," 76 Journal of Policy Economics

1. Components of the Broadband Local Exchange Network

This report defines the broadband local exchange network ("BLEN") as comprising switching and transmission facilities that support switched broadband transport between the premises of residence and business users and 1) the Points of Presence (POPs) of long haul network providers; 2) the POPs of ISPs; and 3) in the case of the ILECs BLENs, the points of interconnection ("POIs") with the networks of other CLECs. The Appendix provides an explanation of the origins and meaning of the term "broadband" (Section B), and a detailed definition of the local exchange network as differentiated from interexchange or long distance network (Section C).

Figure 1, located at the end of this section, shows a high-level view of the BLEN. It contains three essential components:

- broadband access, which is the broadband equivalent of the local "loop" that connects customer premises to the local CO;[80]
- the broadband switch located in the CO and/or transport concentration and multiplexing, where the latter refers to the consolidation of broadband information signals for efficient transport to another point where switching takes place, if not at the CO; and
- exchange area interoffice transport that interconnects COs, the POPs of ISPs, and the POPs or POIs of other broadband service providers, including ILECs, CLECs, and long-haul data network providers.

For completeness, the figure shows the premises network that is communicating over, but is not part of, the BLEN. It also shows certain interface points, labeled "A", "B", etc. These will be discussed later.

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[80] The paper borrows liberally from existing telephone industry terminology; it thus uses "Central Office" to describe the place where customer access lines come together in a single point, at which switching or transmission concentration can take place.

The Figure, and some of the terminology, brings out the equivalency between the BLEN and the local exchange part of the PSTN. Broadband access is the equivalent of the "local loop" in the PSTN and in fact, in at least the near term may utilize existing loops, as discussed in the next section. Access links from different customers come together at a central point which is called the CO.[81] The first point of switching may be located in the CO, and is often referred to in data communications terminology as the "edge switch." Alternatively, the provider may choose to consolidate the edge switches in a more centralized location, labeled a "switch hub" in the figure. In this case, or if the CLEC desires delivery of the broadband signal at some point other than the CO, the interoffice transport system provides "access trunks," represented by a dotted line in the figure, to extend the broadband access to this central point. In either case, the edge switch plays a role in the overall network structure equivalent to that played by the PSTN "end office" or Class 5 switch -- that is, it serves as the subscribers' entry point into the remainder of the switched network. Instead of the interoffice network consisting of transmission facilities only, it may also contain additional broadband switches that provide more flexibility to the routing of calls between COs and between the local exchange and long distance networks; these serve a role roughly equivalent to PSTN tandem switches.

[81] Consistent with the Commission's terminology, we use the term "CO" rather than a more common term for this location, the "wire center." This may be an apt replacement, since wire center seems an inappropriate term when broadband access links may consist of fiber optics or radio transmission, in addition to wire pairs.

2. xDSL Access Technologies

Section D of the Appendix discusses the nature of each of the major components of the BLEN, including broadband access. Section E of the Appendix deals specifically with xDSL, a family of access technologies that is likely to dominate near term deployment of broadband access, at least to residences and small businesses, and which receives considerable attention by the Commission in the Order/NPRM. Here, we summarize some of the salient features of xDSL that have a key impact on the discussion of principles in the next section.

The key attribute of the xDSL family is that it adds broadband electronics to existing wire pairs that meet certain criteria. While the criteria mean there are limitations on which customers can be served by the technology – for instance, they must be within a certain distance of the CO – the changes in the telephone company plant needed to provide broadband access to customers are limited to the addition of discrete electronic components and associated management systems. No changeout in the outside plant structures and media are required. Furthermore, the criteria are likely to ease over time as further developments take place in the technology.

Another key attribute in the case of a member of the xDSL family referred to as Asymmetric Digital Subscriber Line ("ADSL") is that it combines analog voice and broadband "data"[82] streams on the same physical pair of wires. The combined signal is transported over the copper wire pair. At both ends of the pair, there is a "splitter" whose

[82] A variety of data, video, imaging, and even digitized voice signals may be carried in the ADSL bit stream, depending on the applications customers are running over the BLEN. We refer to this as the ADSL "data" stream only as a convenient way to differentiate it from the voice signal xDSL is transmitting.

role is to separate the composite signal into its constitute voice and data components, allowing the voice signal to be connected to a conventional voice switch, while the data signals are sent to a terminal unit that separates the various data signals and forwards them on to the broadband switch.[83]

Figure 2a reflects the use of ADSL as the access technology on all-copper loops – that is, loops where the copper pair serving a given customer extends all the way from the premises to the CO. Compared to Figure 1, the key change is the labeling of the terminals at the CO and premises end of the ADSL link as the ADSL CO Terminal Unit ("ATU-C") and ADSL Remote Terminal Unit ("ATU-R"), respectively, and the addition of the splitters at each end (the splitter function may be integrated with the terminal). The ATU-C is also referred to as a DSL Access Multiplexer, or DSLAM, and the ATU-R is often referred to as an "ADSL modem."

Figure 2b shows the more complicated ADSL configuration when a subscriber is served by a fiber optics digital loop carrier ("DLC") system. In this case, the ATU-C is located at the Feeder-Distribution Interface ("FDI"), which is the location of the DLC Remote Terminal ("RT"). Depending on the course of ADSL and DLC technologies, and the vendors involved, the ATU-C may be a plug-in to the RT, it may be on a separate shelf in the RT enclosure, or it may be in a separate enclosure, with jumper cables between the two cabinets. In any of the cases, the logical treatment is the same. The voice signal from the ATU is digitized and multiplexed over the DLC system like all

[83] At the originating end of the signals, the splitter has the role of receiving the data and voice signals from the data terminal and voice switch, respectively, and combining them into a composite signal using

other non-ADSL voice signals. The data signals from the ATU-C, suitably multiplexed with the ADSL data signals from other subscribers, may be transmitted between the RT and CO in one of three fashions: 1) on separate fibers; 2) on the same fiber, but at different wave lengths, using Wavelength Division Multiplexing ("WDM") to derive additional signals transmitted on optical signals with a different "color" than the original DLC signal; or 3) in the same bit stream as the digitized multiplexed voice signals, with the DLC electronics upgraded to support the higher bit rate. At the CO end of the DLC system, the signal is demultiplexed (if the broadband signal has been multiplexed with the voice signal at the FDI), and the separated digital voice and broadband data signals are forwarded to the voice and broadband switch, respectively. If the edge switch is not located in the CO, or the CLEC desires it to be delivered at another location, the broadband data signal is passed to the "access trunk" we have previously defined to handle such cases.

B. Technology Principles

This section discusses nine technology principles that can serve as a guide to broadband policy.

1. <u>The rules the Commission adopts should not be narrowly-constructed to apply to xDSL only, but should deal with the BLEN generally</u>.

xDSL is only one class of access technologies of several that are likely to emerge over the next several years. The same is likely to be true of broadband switching.

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frequency-division multiplexing – that is, the voice signal occupies a separate part of the frequency spectrum than does the digital signal.

Furthermore, the rules need to deal with the switching and interoffice portions of the BLEN, not just the access portion.

2. The ILECs must provide an end-to-end broadband capability that extends from the premises to the POIs of CLECs.

Providing CLECs access only to the underlying "basic" voice loops that exist today will not be sufficient to stimulate widespread broadband competition. CLECs are in their early stage of existence. At this stage, most do not have the ubiquitous presence, current resources, or revenue streams to maintain a presence in each ILEC local exchange area, let alone in each CO or at an integrated digital loop carrier remote terminal ("IDLC RT"). This is precisely why the ILECs retain substantial market power over local telephone networks. If CLECs are given access only to underlying unbundled basic loops, they either will have to invest to obtain such an ubiquitous presence or purchase expensive trunking arrangements from the ILECs to transport large amounts of bandwidth to a more centralized CLEC POI. If this were economic, they would be doing it today to compete for traditional telephone services.

Second, while it is entirely appropriate, and in fact critically important, for the Commission to carefully specify detailed non-discrimination requirements, and associated penalties for non-compliance with those requirements, the fact remains that there are an enormous number of opportunities for the ILECs to practice discrimination in the provision of unbundled loops. To precisely define non-discrimination requirements for each of these potential forms of abuse will be time-consuming, complex, potentially impossible in the face of a determined effort on the part of the ILECs to thwart the requirements, and further difficult when it comes to defining related monitoring and

reporting requirements. A few of the potential abuses the ILECs may practice in providing unbundled basic loops are described below. The Commission must define non-discrimination requirements to guard against these and other potential abuses.

- An ILEC selectively deploys xDSL technologies in areas where its own subsidiary desires them.
- The ILEC can find xDSL-capable loops when its own subsidiaries needs them, but not when a CLEC needs them.
- The loops provided to the subsidiary possess transmission characteristics that make them more suitable for broadband transmission, on the average, than are those provided to the CLECs.
- The ILEC determines that collocation space is available in COs where its subsidiaries require it, but not in COs where a CLEC wishes to collocate.
- The ILEC is selectively slow to deploy SONET management systems on the interoffice links from COs to POIs.
- ILEC customer service representatives imply that access to ISPs will be of better quality if provided directly via the ILEC broadband network than if connected through a CLEC network.

Third, many of the interfaces to underlying loop elements will require the specification of interface attributes such as the communications protocol used. Such specifications may take a long time to develop in some cases, particularly in the face of concerted ILEC resistance to the development. Furthermore, standards development is made more difficult by the embryonic state of broadband access and switching equipment. This both ensures there are likely to be competing proposals to be resolved, and leads to the high likelihood that standards, once adopted, will soon be rendered obsolete by new technology developments.

Fourth, ILECs are likely to argue that some of the interfaces to basic loops are difficult or impossible to provide, raise the specter of network harms, or go beyond their responsibilities under the '96 Act. For instance, basic loops provisioned on DLC systems require the DSLAM to move from the CO out to the IDLC RT, where it may take the

form of plug-in cards in the RT. Furthermore, the capacity of the DLC systems must be increased through the use of additional fibers, upgrading the bit rate on existing fibers by increasing the speed of the associated electronics, and/or using wave division multiplexing to provide for additional broadband bit streams on existing fibers.

The ILECs will almost surely mount, on specious grounds, an argument against the feasibility of allowing CLEC electronics in their RTs. In addition, they are likely to mount arguments against, or impede, the various methods of increasing capacity on the DLC system. They will likely argue that with IDLC, coupled with the addition of broadband switching adjuncts to existing voice switches, it will be impossible or inefficient to divert the bit streams of the CLECs' customers to the CLEC collocation cages. Finally, they will argue against the feasibility and legality of requiring them to provide collocation for CLEC switches, forcing the CLECs into less efficient transport arrangements. The likelihood of such arguments is not theoretical: similar arguments have been put forth by one ILEC or another during the implementation of the '96 Act's Unbundled Network Element ("UNE") requirements.[84]

Fifth, as a critical example of required interfaces, parity between the CLECs and ILECs in the identification and use of basic loops requires that the CLECs have access to the same OSS that the ILECs use to test, provision, and maintain basic loops. ILECs currently deploying ADSL services, for instance, commonly make real-time tests of loops to determine their adequacy for supporting ADSL at the time customers call to inquire about service. The customer will often receive a report minutes later. CLECs require no

[84] See ALTS Petition.

less access to the Mechanized Loop Testing system that performs such tests and reports the results. But this kind of CLEC access to ILEC OSS has been notoriously slow in coming during the implementation of the Act's UNE requirements.

Finally, as noted above, there is potential for an early obsolescence of the Commission's non-discrimination requirements if they are too technology-specific. There is little doubt that some or all of the ILECs have a long-term vision of deploying fiber to the curb or fiber to the home systems, which would eliminate the use of xDSL-equipped copper loops in broadband networks altogether. As that happens -- and it is already happening on a limited scale -- the Commission will be forced to define new non-discrimination requirements applicable to these new loops. In addition, they will have to deal with a new form of discrimination that will be difficult to detect and remedy: the premature upgrading of copper loops to fiber loops by ILECs for competitive reasons, thereby causing CLECs to have to spend additional resources on purchasing the new loop arrangements, or being stuck with obsolete copper loops that are no longer properly maintained by the CLECs. For the ILECs' part, the purchase of copper loops by CLECs may thwart the ILECs' legitimate needs to upgrade selected parts of their loop plant. For all of these reasons -- and the above represent only a sampling of the issues that arise if the CLECs' fortunes are to depend on the availability of only unbundled basic loops and collocation in COs – many CLECs must have the ability to purchase integrated broadband connections from their customers' premises to their POIs from the ILECs.

3. <u>The Commission's proposal to differentiate between the regulated entity and the separate subsidiary in terms of the former providing unbundled narrowband network elements and the latter adding broadband elements, including the DSLAM, is inappropriate</u>.

This follows from the second principle, and the accompanying discussion of the forms of discrimination the ILECs will be in a position to practice if that is the extent of their obligation. Furthermore, it would seem to fly in the face of the Commission's concerns about the transfer of broadband elements -- DSLAMs, broadband-enhanced DLC systems and CO equipment, ATM switches, and interoffice transport used for broadband (that is, non-channelized) transmission -- to the unregulated subsidiary. Instead, what the Commission should require is that the ILECs provide to all entities, including their own broadband subsidiary, on a non-discriminatory basis, premises-to-POI broadband capabilities that they are already deploying. The separate subsidiary would then provide customers with broadband services based on these underlying broadband network components under the same terms and conditions that apply to all CLECs.

The incentive for the ILECs to provide such broadband capabilities in a fashion that meets the CLECs', and their own subsidiary's,[85] needs in a positive and non-discriminatory fashion is that those capabilities would lessen CLECs' incentives to inefficiently extend their own broadband facilities to COs and on to the customers' premises. They would thereby ensure that they would play a major role in the unfolding broadband marketplace. By contrast, if they were limited to having to provide unbundled basic loops to CLECs, the enormous opportunities for discrimination on behalf of their own broadband subsidiary in the various forms described by example above would ensure

[85] Since, in this Report's proposed treatment, the separate subsidiaries are similar in every way to CLECs, we will henceforth primarily refer to "CLECs," rather than unduly repeating "CLECs and the separate subsidiary."

the subsidiary's place in the broadband marketplace, but at the likely expense of robust broadband competition and at the expense of not having a basic broadband local network available to all potential providers of broadband services.

Anticipating the subsequent discussion of standards, and in light of a previous point about the potential obsoleting of the Commission's requirements if they are too technology-specific, this section concludes by identifying two additional advantages of requiring such end-to-end broadband capabilities. First, such capabilities can be defined in terms of only the interfaces they provide at their end-points. In this fashion, the need to define standards pertaining to the elements between the end-points are eliminated or delayed. For instance, it becomes unnecessary to immediately specify numerous detailed CO collocation requirements.

Second, the specifications become much more technology-independent. If the capability is defined in terms of the bandwidth, features, and quality of the information at the end points, then the ILECs can continue to innovate in the deployment of technologies that meet those specifications. Thus, the specifications can be neutral with respect to, say, the use of copper-based xDSL systems versus fiber-to-the-curb systems. This advantage should not be carried too far, however -- the end-point specifications may still depend on the technology utilized to some extent. For instance, whether the data communications protocol at the POI interfaces is ATM, IP, another fast packet switching protocol like frame relay, or combinations of the above depends on the type of switching deployed in the ILEC broadband networks.

4. While some CLECs will only be able to utilize the end-to-end broadband capability specified in principle (2), the ILECs should also be required to provide unbundled components of their broadband networks to CLECs who are able to utilize them.

There are several compelling reasons why the ILECs should also be required to provide unbundled components of their broadband networks to CLECs, conditioned on the extent the CLECs have the sophistication and marketplace presence to utilize network components in lieu of the end-to-end capabilities, and therefore request such components.

First, there is the same motivation as exists for requiring the ILECs to provide narrowband UNEs; namely, that broadband UNEs elements will stimulate competition by allowing competitors to phase in the deployment of their own facilities, and to selectively deploy only those facilities that are more economically efficient for them to deploy than for the ILECs to deploy. In other words, this will provide competitors to share in the economies of the local network.[86]

Second, by contrast, the ability of the CLECs to deploy certain facilities in a targeted fashion acts to maximize the efficiency of the ILEC in competing to be the provider of those elements. Third, the provision of selected network components by a CLEC allows it to compete on the basis of cost, features, and quality, thereby enabling it to better differentiate its services from those of other providers than if all providers buy their entire broadband networks from the same supplier. Some CLECs may want to carry this differentiation to the point of utilizing the underlying basic loop, and adding all of their own broadband equipment, such as the DSLAM.

[86] Interconnection Order.